

## CHAPTER XXXVI.

Origin of the metamorphic rocks, *continued*—Definition of joints—slaty cleavage and foliation—Supposed causes of these structures—Mechanical theory of cleavage—Condensation and elongation of slate rocks by lateral pressure—Supposed combination of crystalline and mechanical forces—Lamination of some volcanic rocks due to motion—Whether the foliation of the crystalline schists be usually parallel with the original planes of stratification—Examples in Norway and Scotland—Foliation in homogeneous rocks may coincide with planes of cleavage, and in uncleaved rocks with those of stratification—Causes of irregularity in the planes of foliation.

WE have already seen that crystalline forces of great intensity have frequently acted upon sedimentary and fossiliferous strata long subsequently to their consolidation, and we may next inquire whether the component minerals of the altered rocks usually arrange themselves in planes parallel to the original planes of stratification, or whether, after crystallization, they more commonly take up a different position.

In order to estimate fairly the merits of this question, we must first define what is meant by the terms cleavage and foliation. There are four distinct forms of structure exhibited in rocks, namely, stratification, joints, slaty cleavage, and foliation; and all these must have different names, even though there be cases where it is impossible, after carefully studying the appearances, to decide upon the class to which they belong.

Professor Sedgwick, whose essay "On the Structure of large Mineral Masses" first cleared the way towards a better understanding of this difficult subject, observes, that joints are distinguishable from lines of slaty cleavage in this, that the rock intervening between two joints, has no tendency to cleave in a direction parallel to the planes of the joints; whereas a rock is capable of indefinite subdivision in the direction of its slaty cleavage. In some cases where the strata are curved, the planes of cleavage are still perfectly parallel. This has been observed in the slate rocks of part of Wales (see fig. 706), which consist of a hard greenish

Fig. 706.



Parallel planes of cleavage intersecting curved strata. (Sedgwick.)

slate. The true bedding is there indicated by a number of parallel stripes, some of a lighter and some of a darker color than the general